Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of the claims in the application:

Listing of Claims

1. – 4. (cancelled)

5. (currently amended) An apparatus comprising:

a single substrate;

a microchannel defined in the substrate;

at least one integrated peristaltic GaN micropump for pumping fluid to be analyzed, operatively and integrally formed about a corresponding portion of the microchannel in the substrate using photo-electro-chemical etch techniques (PEC), which corresponding portion comprises a pumping chamber of the peristaltic micropump;

a plurality of integrated analysis chambers for an analyte communicated to the microchannel and hence to the pumping chamber of the at least one integrated peristaltic micropump; and

a plurality of integrated analysis devices integrally manufactured into the substrate using nitride processes compatible with PEC and operatively communicated to the ~~to test said fluid in said~~ analysis chambers ~~for an analyte~~;

~~where said analysis devices in said plurality of analysis chambers comprise an integrated LED and an integrated optical detector~~

~~where said integrated LED and integrated optical detector comprise means tuned to an optical absorption line of said analyte~~.

6. (currently amended) An apparatus comprising:

a single substrate;

a microchannel defined in the substrate;

at least one integrated GaN peristaltic micropump for pumping fluid to be analyzed operatively and integrally formed about a corresponding portion of the microchannel in the substrate using photo-electro-chemical etch techniques (PEC), which corresponding portion comprises a pumping chamber of the peristaltic micropump;

a plurality of integrated analysis chambers communicated to the microchannel and hence to the pumping chamber of the at least one integrated peristaltic micropump; and

a plurality of integrated analysis devices integrally manufactured into the substrate using nitride processes compatible with PEC and operatively communicated to the ~~to test said fluid in said~~ analysis chambers for an analyte

where said micropump comprises:

an electro-deformable GaN membrane;

~~a~~ the substrate disposed below said membrane and coupled thereto, ~~a~~ the microchannel defined between said membrane and substrate, said microchannel having a longitudinal axis; and

an electrode structure disposed on at least one side of said membrane along side of said microchannel.

7. (original) The apparatus of claim 6 where said electro-deformable membrane is bowed to form a curvature having a symmetrical axis in the direction of said longitudinal axis of said microchannel.

8. (original) The apparatus of claim 6 further comprising a drive circuit coupled to said electrode structure to apply a sequential voltage along said plurality of opposing electrodes to peristaltically deform said electro-deformable membrane in the direction of said longitudinal axis of said microchannel.

9. (previously presented) The apparatus of claim 6 where said electro-deformable membrane consists of p-type GaN.

10. (previously presented) The apparatus of claim 7 where said electro-deformable membrane consists of p-type GaN.

11. (currently amended) An apparatus comprising:

a single substrate;

a microchannel defined in the substrate;

at least one integrated GaN peristaltic micropump for pumping fluid to be analyzed, operatively and integrally formed about a corresponding portion of the microchannel in the substrate using photo-electro-chemical etch techniques (PEC), which corresponding portion comprises a pumping chamber of the peristaltic micropump;

a plurality of integrated analysis chambers communicated to the microchannel and hence to the pumping chamber of the at least one integrated peristaltic micropump;

a plurality of integrated analysis devices integrally manufactured into the substrate using nitride processes compatible with PEC and operatively communicated to the ~~to test said fluid in said~~ analysis chambers for an analyte, and

two opposing pillars disposed on said substrate between said substrate and said membrane generally aligned in the direction of said longitudinal axis,

where said micropump comprises:

an electro-deformable GaN membrane;

a substrate disposed below said membrane and coupled thereto, a microchannel defined between said membrane and substrate, said microchannel having a longitudinal axis; and

an electrode structure disposed on at least one side of said membrane along side of said microchannel.

12. (previously presented) The apparatus of claim 11 where said electro-deformable membrane is bowed to form a curvature having a symmetrical axis in the direction of said longitudinal axis of said microchannel.

13. (previously presented) The apparatus of claim 11 ~~8~~ further comprising a drive circuit coupled to said electrode structure to apply a sequential voltage along said plurality of opposing electrodes to peristaltically deform said electro-deformable membrane in the direction of said longitudinal axis of said microchannel.

14. (previously presented) The apparatus of claim 11 where said electro-deformable membrane is bowed to form a curvature having a symmetrical axis in the direction of said longitudinal axis of said microchannel and where said electro-deformable membrane is composed of p-type GaN,.

15. (original) The apparatus of claim 14 where said two opposing pillars are composed of n-type GaN.

16. (currently amended) An apparatus comprising:

a single substrate;

a microchannel defined in the substrate;

at least one integrated peristaltic GaN micropump for pumping fluid to be analyzed, operatively and integrally formed about a corresponding portion of the

microchannel in the substrate using photo-electro-chemical etch techniques (PEC), which corresponding portion comprises a pumping chamber of the peristaltic micropump;

a plurality of integrated analysis chambers communicated to the microchannel and hence to the pumping chamber of the at least one integrated peristaltic micropump; and

a plurality of integrated analysis devices integrally manufactured into the substrate using nitride processes compatible with PEC and operatively communicated to the ~~to test said fluid in said~~ analysis chambers ~~for an analyte~~,

where said micropump comprises:

an electro-deformable GaN membrane; a substrate disposed below said membrane and coupled thereto,

a microchannel defined between said membrane and substrate, said microchannel having a longitudinal axis; and

an electrode structure disposed on at least one side of said membrane along side of said microchannel,

where said electrode structure is comprised of two opposing electrode substructures extending parallel to said microchannel.

17. (original) The apparatus of claim 16 where said two opposing electrode substructures each comprise a plurality of discrete electrodes arranged and configured to provide pairs of opposing electrodes on each side of said microchannel.

18. – 20. (cancelled)

21. (new) The apparatus of claim 5 where the integrated analysis chambers are portions of the microchannel.

22. (new) The apparatus of claim 21 where integrated peristaltic micropump comprises a distributed integrated peristaltic micropump comprised of a plurality of micropump sections driven as a single micropump.

23. (new) The apparatus of claim 22 where each of the portions of the microchannel serving as the analysis chamber and each integrated analysis device are pairwise associated with a micropump section of the distributed integrated peristaltic micropump.